



Col Pro 2002 Conference

DARPA's Immune Building Program

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Director
Special Projects Office

29 October 2002

At Least 5 Die, 500 Hurt as Explosion Rips Garage Under World Trade Center, Bomb Suspected In Midday Blast, Thousands Injured

The Washington Post, February 27, 1993

Bomb Kills Dozens in Oklahoma Federal Building

Washington Post, April 20, 1995

149 Confirmed Dead in Embassy Blast

The Washington Post, August 07, 1998

THE WARSHIP EXPLOSION: BLAST KILLS SAILORS ON U.S. SHIP IN YEMEN

New York Times, October 13, 2000

The Bombing at Khobar

The Washington Post, June 27, 1996

A terrorist truck bomb in eastern Saudi Arabia has claimed the lives of 19 Americans, all serving in the U.S. Air Force, and has wounded dozens more. The familiar words come to mind -- shameful, cowardly -- but they do not ease the families' grief nor make...

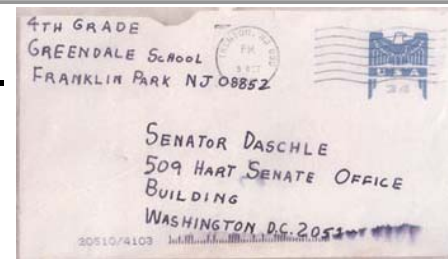
U.S. Attacked; Hijacked Jets Destroy Twin Towers and Hit Pentagon in Day of Terror

New York Times, September 12, 2001

It kept getting worse. The horror arrived in episodic bursts of chilling disbelief, signified first by trembling floors, sharp eruptions, cracked ...



The Pentagon – damage from 9/11/2001



- Force protection remains a significant technical challenge.
- Buildings are a major target for attack:
 - Visible target for anti-US sentiment.
 - Military bases are critical to operations, including staging and power projection.
- Future attacks may use bio or chem weapons in place of explosives.

Threat:

- Focus is on protecting military buildings from:
 - attack by chem or bio warfare agents;
 - external or internal release.

**Focus is on
internal attack**

Goal:

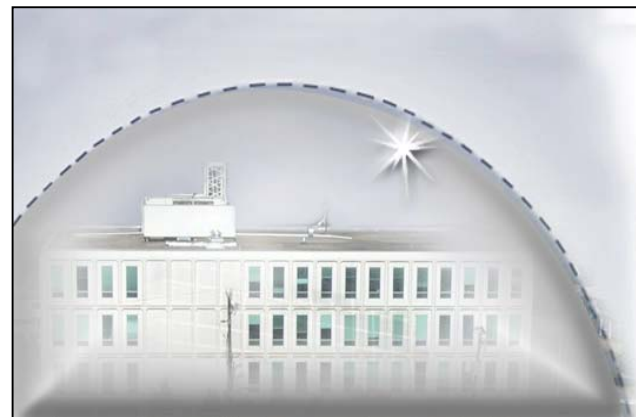
- Make buildings far less attractive targets.

Approach:

- Reduce effectiveness of attack via dynamic response of HVAC (and other) infrastructure.

Objectives:

- Protect human occupants:
 - stop/neutralize agent before it reaches humans.
- Restore building to function, quickly:
 - decontaminate effectively.
- Preserve forensic evidence.



Intelligence
& Warning

Vaccines

Years

Months

Days

Minutes

EVENT

Minutes

Hours

Days

Months

Dynamic
Response

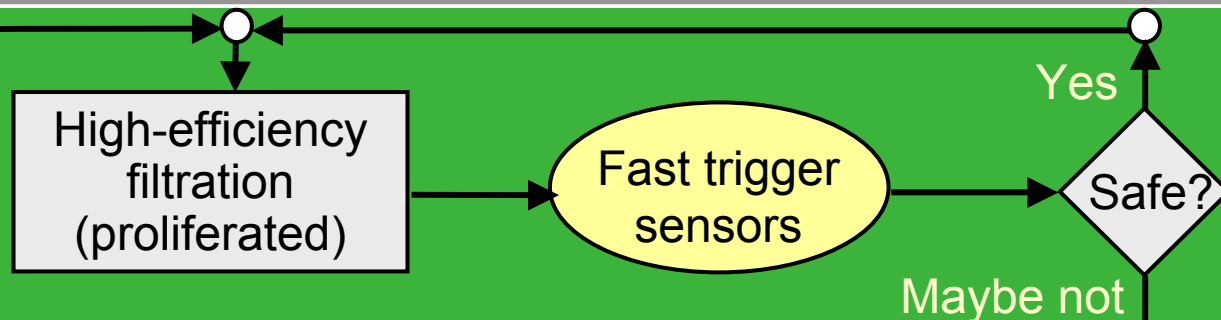
Consequence
Management

Diagnostics & Therapeutics

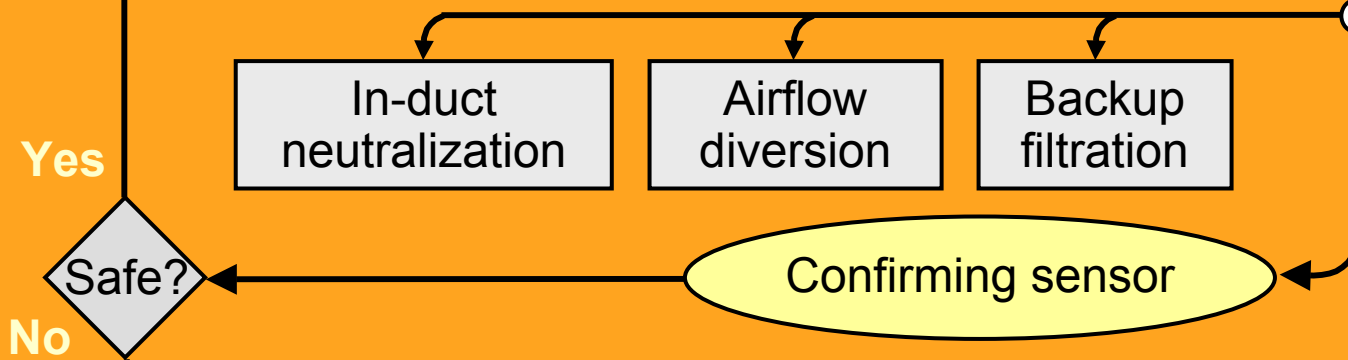


The **Immune Building** program will initiate active defenses during the attack, to reduce agent spread and/or agent lethality.

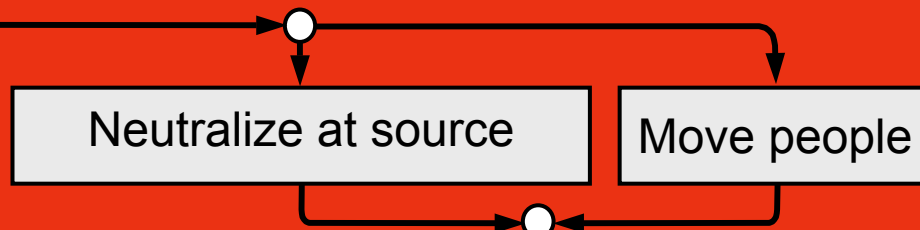
Normal Operation



Possible Attack



Confirmed Attack



Post Event



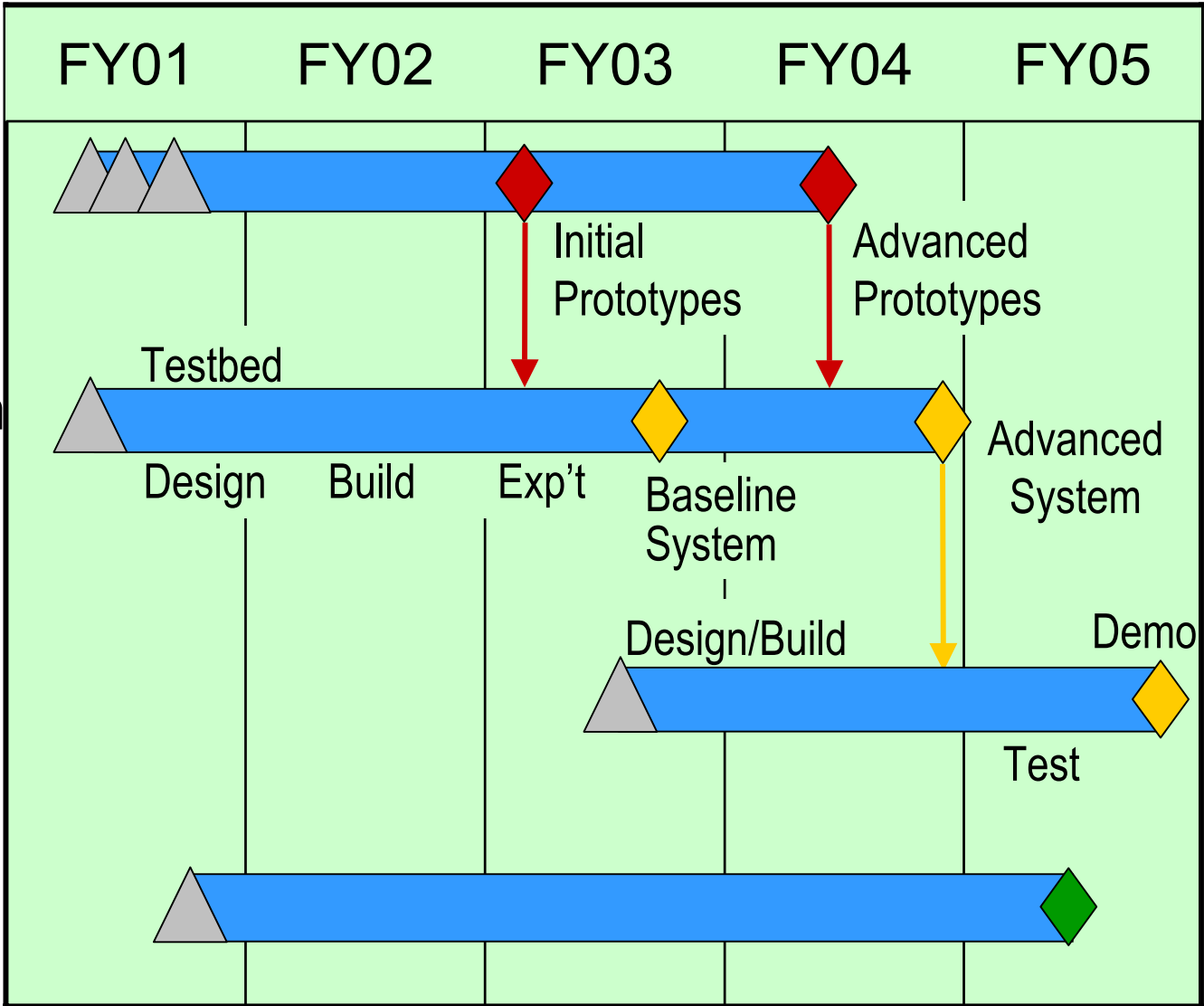


Immune Building Program Components



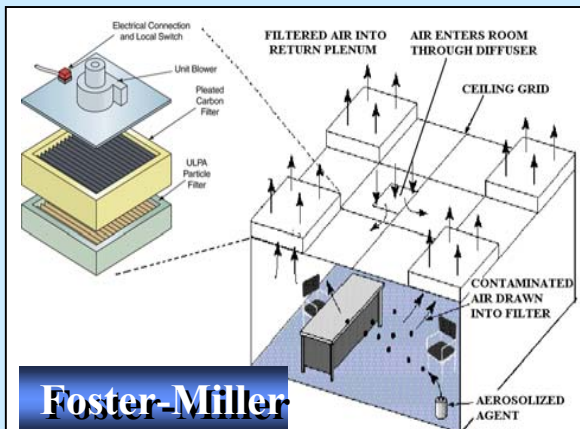
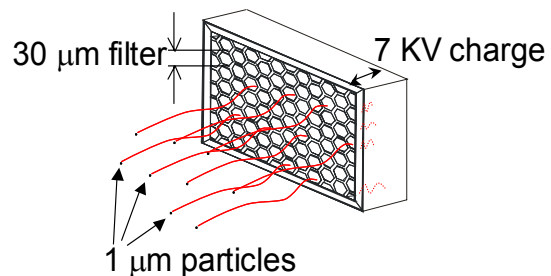
Challenge	Program Component
<ul style="list-style-type: none">• Many enabling components and technologies do not exist today.	<ul style="list-style-type: none">• Technology Development<ul style="list-style-type: none">– Component development and testing
<ul style="list-style-type: none">• Active-response building protection has never been demonstrated.• Data and models to fully and confidently perform systems trades and systems evaluations do not exist.	<ul style="list-style-type: none">• Integrated System Experimentation<ul style="list-style-type: none">– End-to-end systems analysis and <u>full-scale</u> experimentation
<ul style="list-style-type: none">• Active chem/bio building protection has never been used in an operational military building.	<ul style="list-style-type: none">• Demonstration<ul style="list-style-type: none">– Active protection system demonstrated in operational building
<ul style="list-style-type: none">• No validated capability exists to design and optimize future building protection systems.	<ul style="list-style-type: none">• Toolkit: Validated software-based planning tool to:<ul style="list-style-type: none">– assess building threat/vulnerability– assess effectiveness of protection systems options

- Technology Development
- Integrated System Experimentation
- On-site Demonstration
- Toolkit

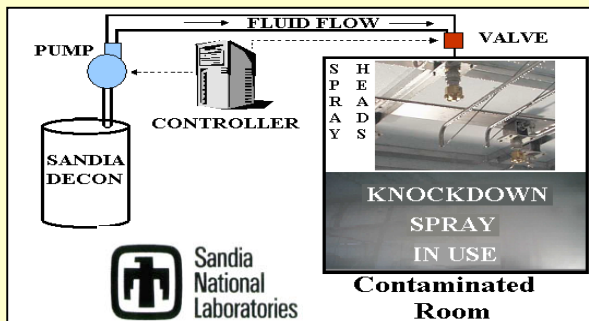
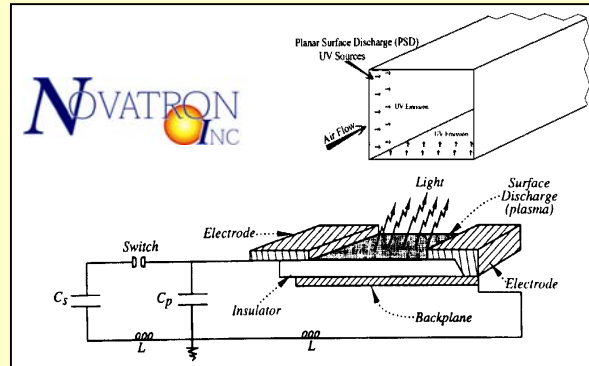


Filtration

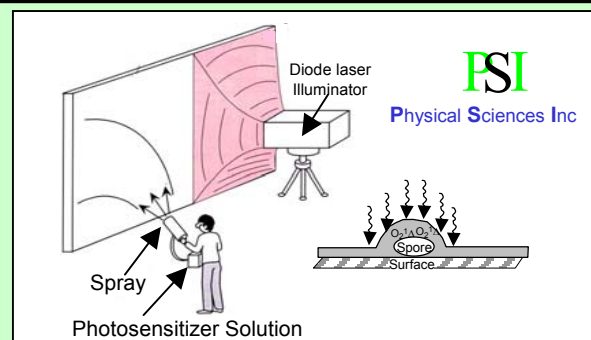
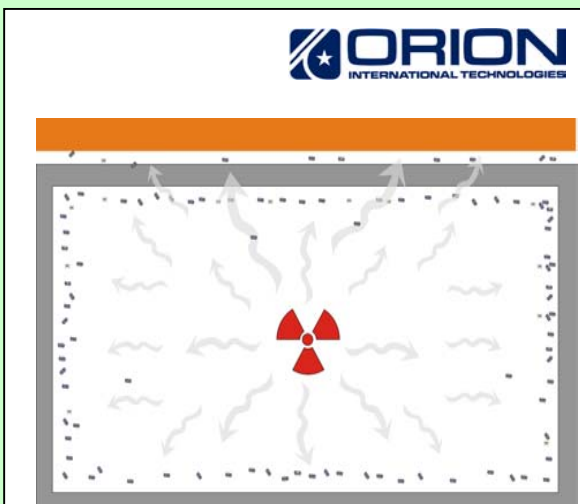
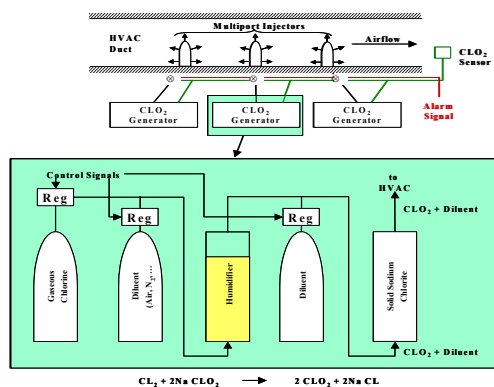
Y2 Ultra-

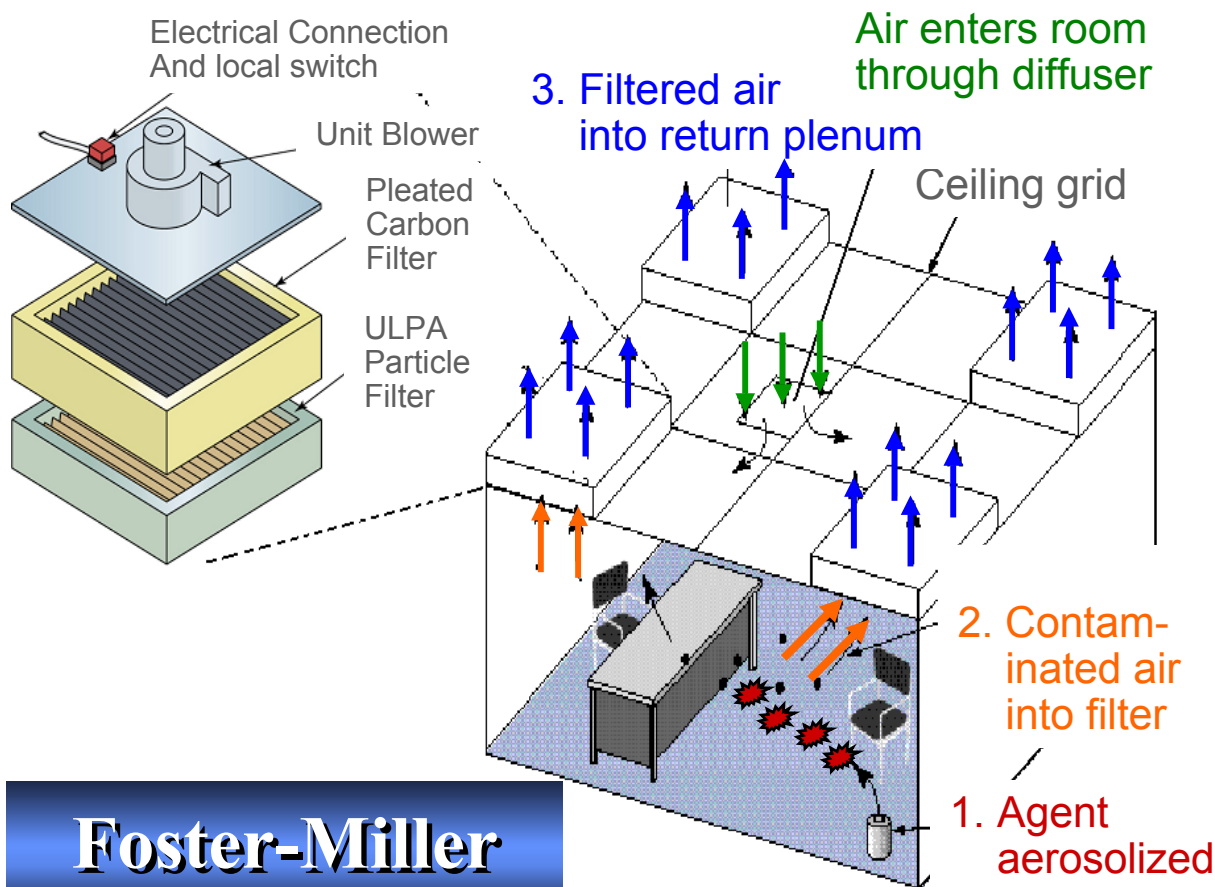


Neutralization



Decontamination





Goal:

- High-efficiency agent capture at return vent

Used:

- Normal operation

Approach:

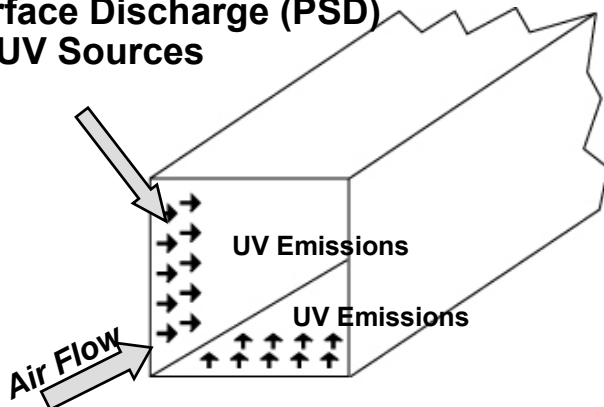
- Pre-filter
- ULPA filter
- Carbon fiber mat
- Small blower

Contact: David Walker, dwalker@foster-miller.com

Poster
Session

NOVATRON
INC

Planar Surface Discharge (PSD) UV Sources



Goal:

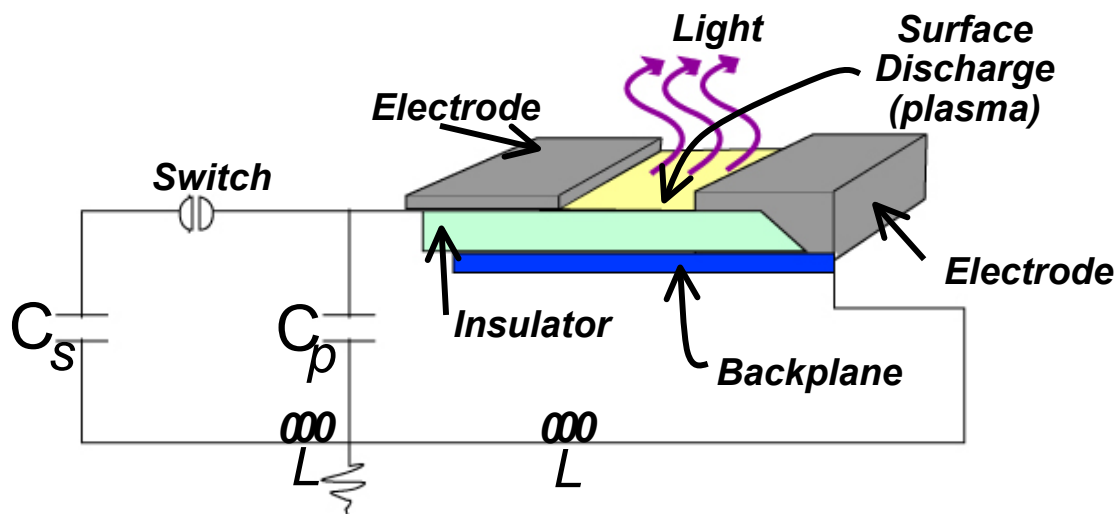
- Ultra-high kill of BWA in ducts ($> 10^7$)

Used:

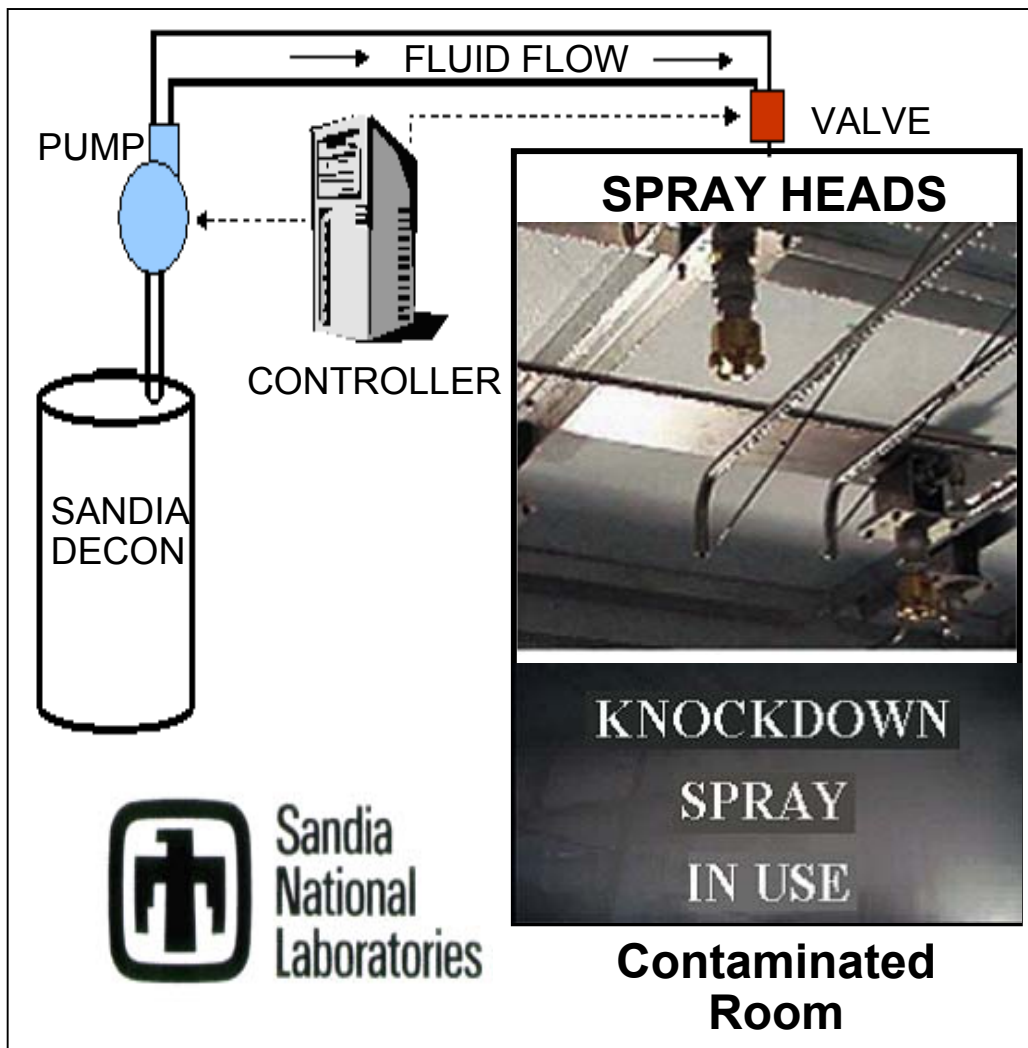
- Precautionary mode

Approach:

- High peak power, short pulse UV
- Efficient production of UV
- Durable, long-lifetime emitter



Contact: Wayne Clark, wayne@novatroninc.com



Goal:

- In-room knockdown and neutralization of agent

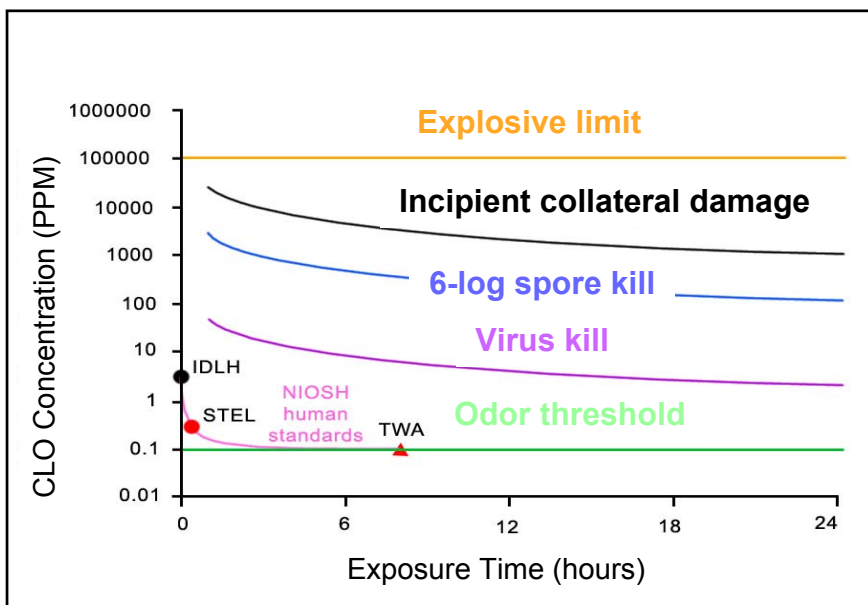
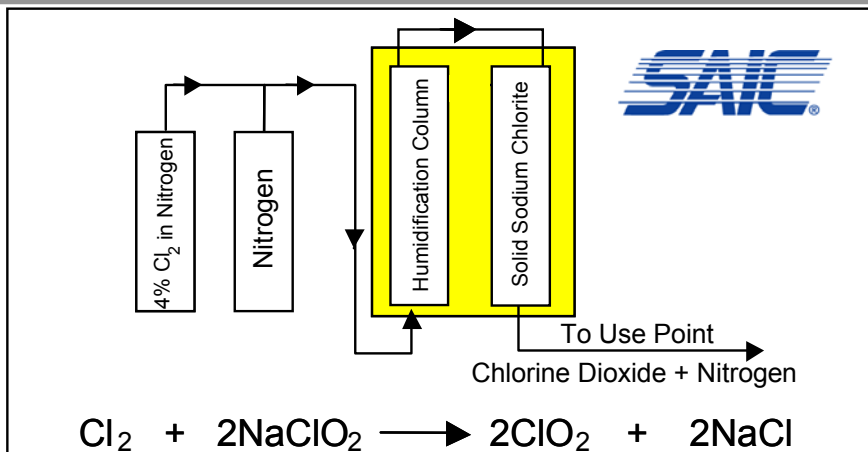
Used:

- After confirmation of attack

Approach:

- Create large droplets using biocidal liquid
- Droplets capture and kill aerosolized agent
- Recondensed liquid collected for disposal

Contact: Cecelia Williams, cvwilli@sandia.gov



Goal:

- Decontamination of difficult-to-reach surfaces

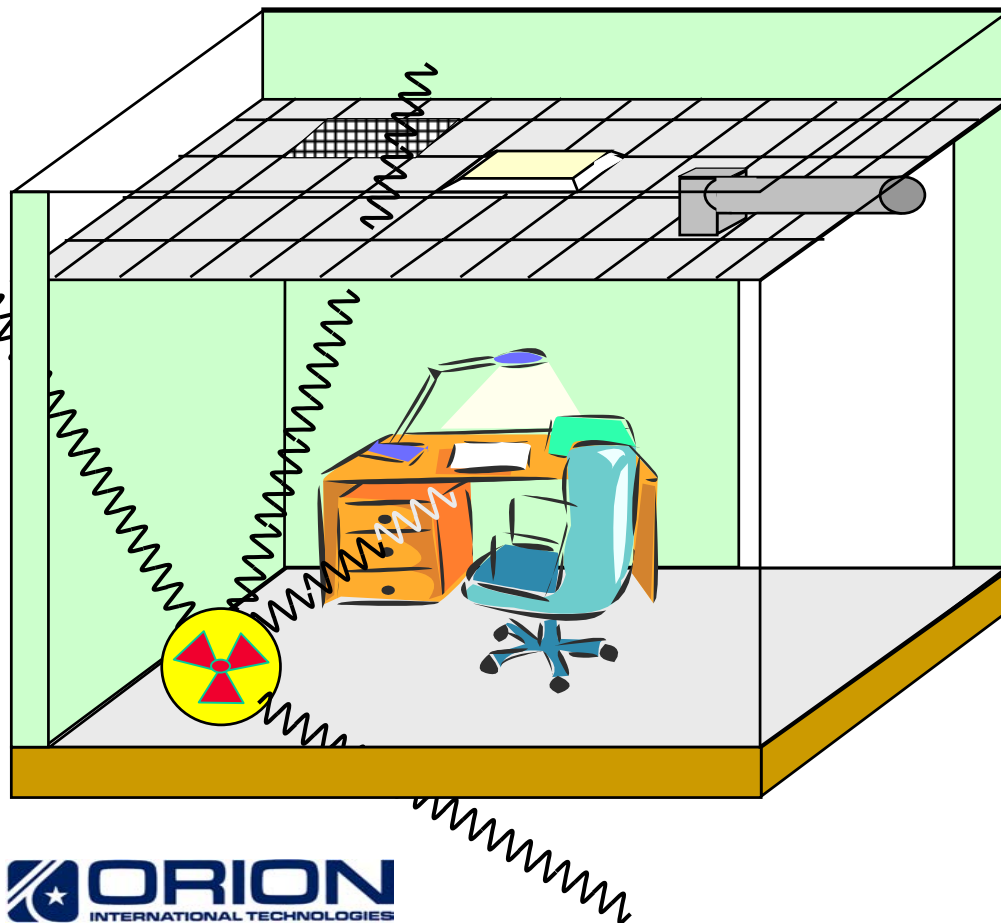
Used:

- Post-event remediation

Approach:

- Seal building
- Raise humidity
- Generate ClO_2 on-site; fumigate
- Scrub ClO_2 from air

Contact: Dino Sofianos, DINO.J.SOFIANOS@saic.com



Goal:

- Decontamination of difficult-to-reach surfaces

Used:

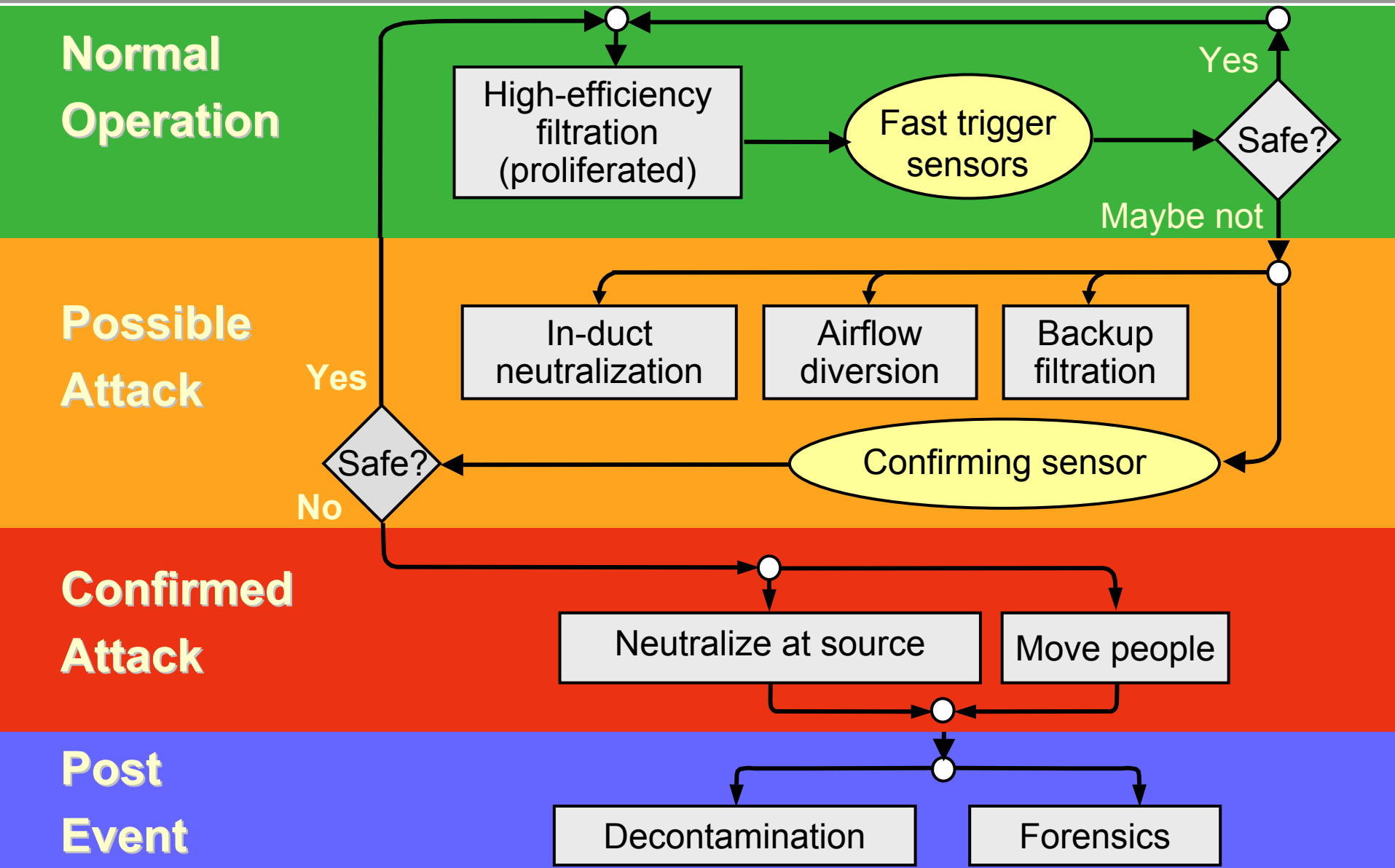
- Post-event remediation

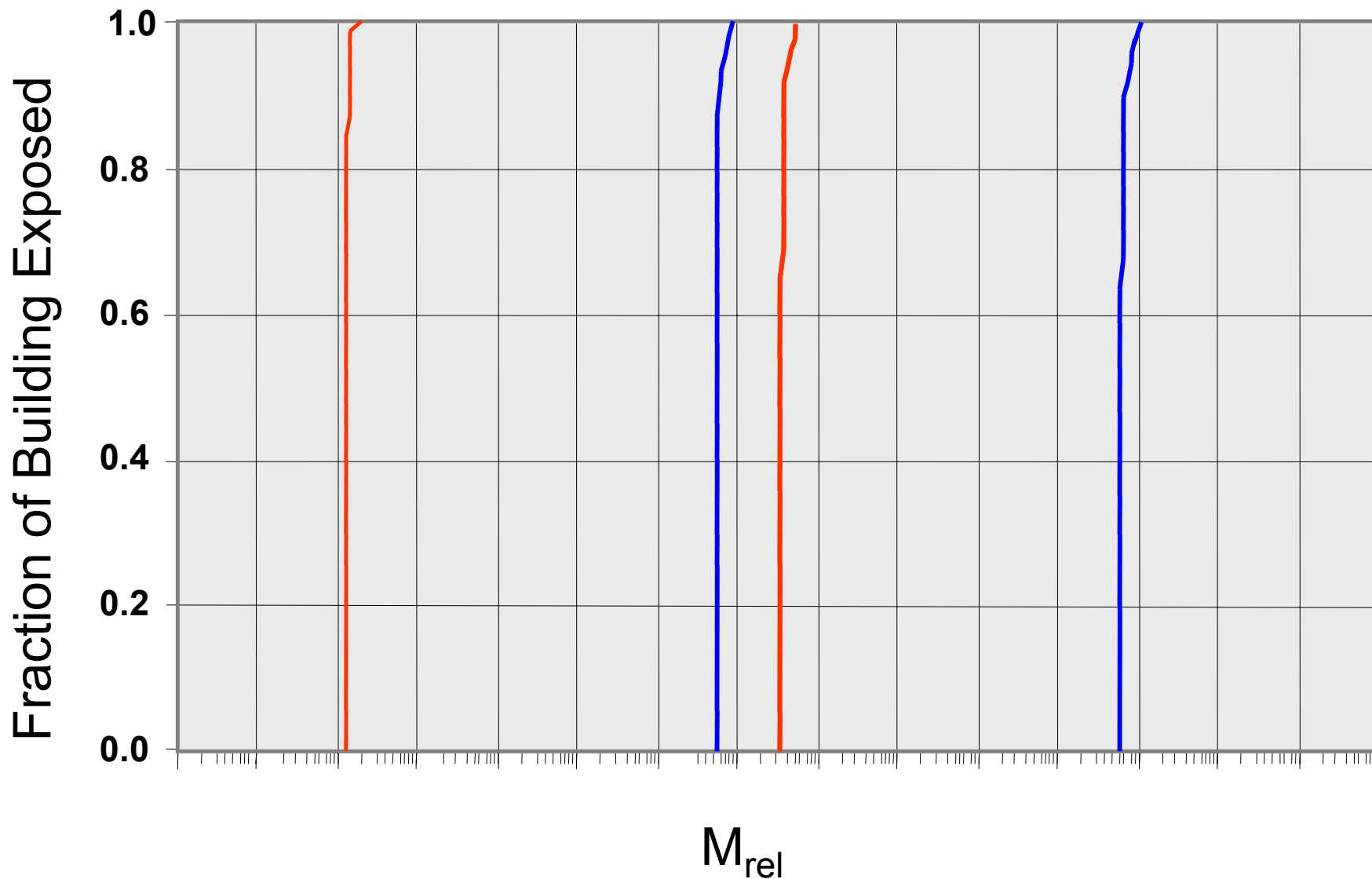
Approach:

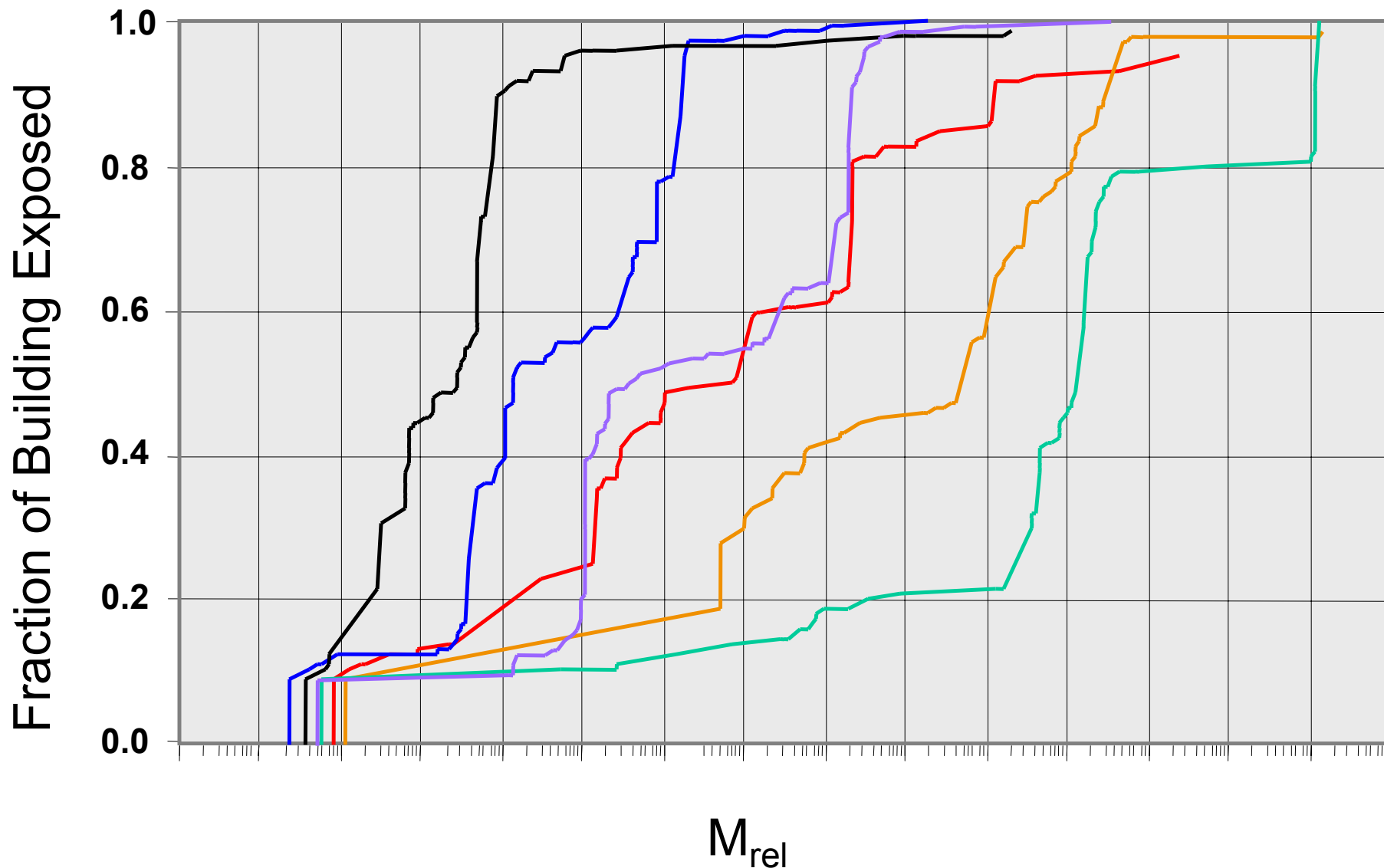
- Place radioactive source (e.g. ^{60}Co) in buildings
- High-energy gamma radiation penetrates walls, breaks DNA strands on contact

(Note: Approach not cost effective in this application)

Contact: Don Puffer, DPuffer@orionint.com









Nevada Test Site

- Bechtel National, Inc.



- SAIC



- Lockheed Martin/NESS



- Bechtel Nevada @
DoE (NNSA)



Contact: David O'Flynn, DKOflynn@bechtel.com



Fort McClellan, Anniston, AL

- Gage-Babcock & Associates



- Battelle



- Auburn University



- Ensco, Inc



- Fidelity Engineering Corp.



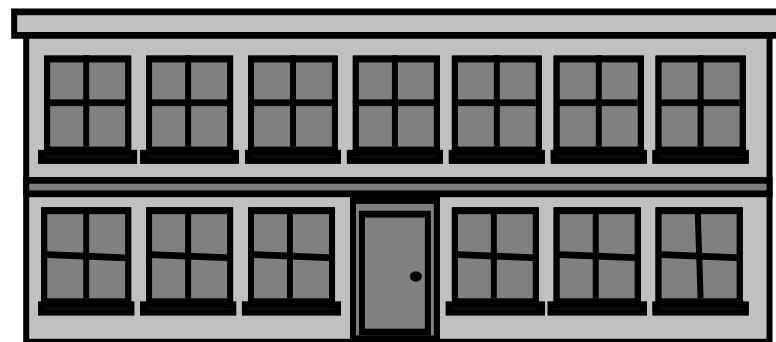
- University of Missouri

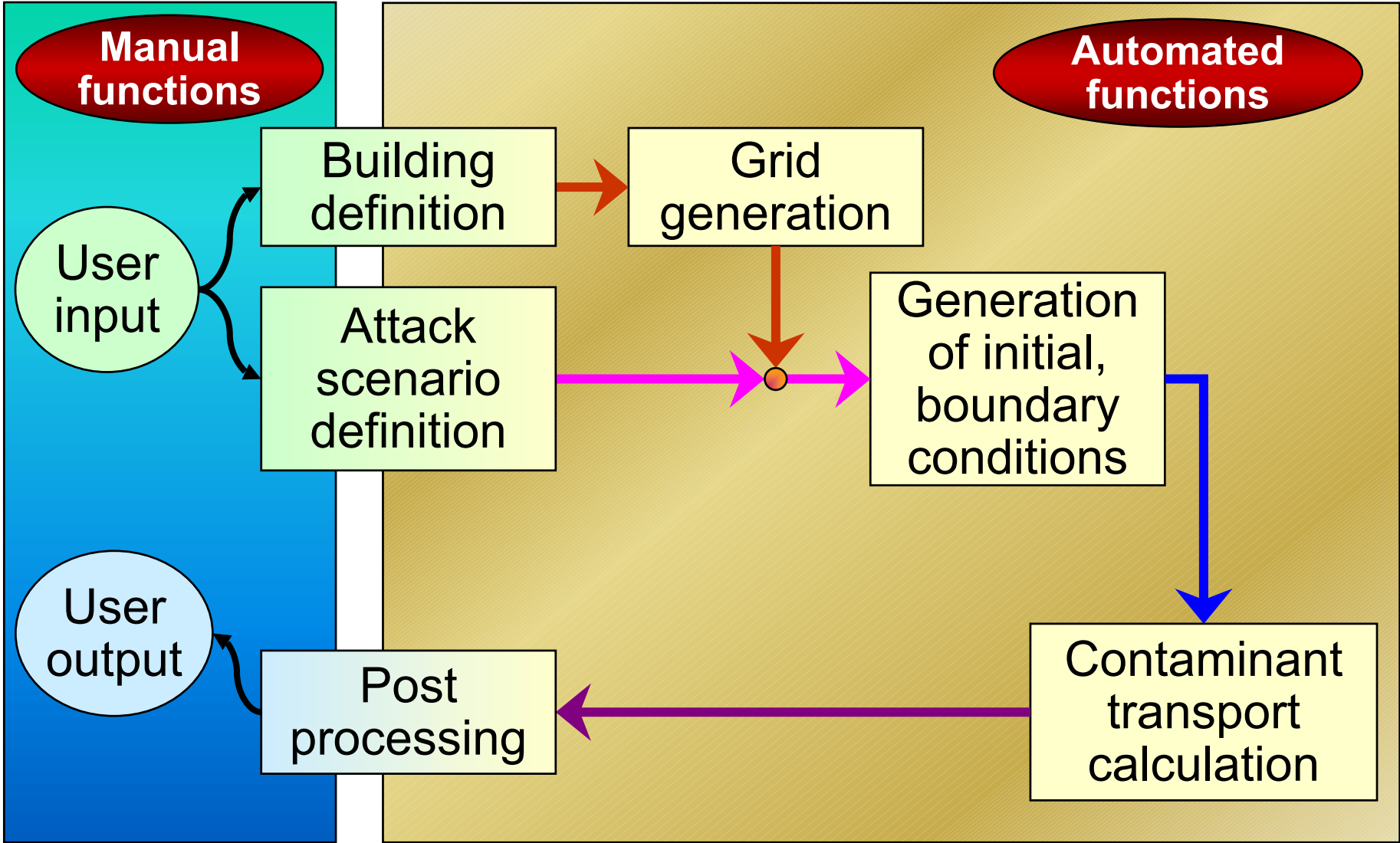


Contact: James E. Risser, risserj@battelle.org

Implement, optimize, and demonstrate a full-scale building protection system at a US military site

- FY03: Site selection
- FY04: System design and testing; on-site characterization
- FY05: Demonstration





Poster
Session



Sensor Laydown			
Location	Label	Sensitivity	Delay
2	2	1.0E-4	10
7	7	1.0E-4	0
17	17	1.0E-5	0
22	22	1.0E-5	0

Thinned SLM		All Releases		Fixed Releases		Potential Release Node
1st	2nd	3rd	4th	5th	6th	
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7, 10
14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14
17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4, 5, 6, 8, 9, 11, 12, 13

Goal:

- Location of source, based on sensor output

Used:

- Toolkit (planning)
- Real-time response

Approach:

- Select sensor laydown
- Run transport model
- Determine sensor response
- Identify possible release locations
- ... (Select HVAC response)

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Other Contacts



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- Rich Heiden, PDC, Richard.L.Heiden@nwo02.usace.army.mil
- Glen Moore, Toolkit lead, MooreGR@nswc.navy.mil